(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
YEAR FOUR SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF
BACHELOR OF SCIENCE COMPUTER SCIENCE

COURSE CODE : CSC 412

COURSE TITLE : OPERATIONS RESEARCH

DATE: 17/06/2021 TIME: 09:00 A.M – 11:00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO

QUESTION ONE [COMPULSORY][30 MARKS]

a) Explain the following terms as used in operation research

i) Surplus variable [1 mark]

ii) Basic variable [1 mark]

iii) Transportation problem [1 mark]

iv) Post optimality [1 mark]

b) Write a zero-one programming model for assignment problem. [3 marks]

c) A manager has three jobs to be assigned to three of his clerical staff. Clerical staff differs in efficiency. The efficiency is a measure of time taken by them to do various jobs. The matrix given below shows the time taken by each person to do a particular job.

Men (Time taken to do job in hours)

Jobs	X	Y	Z
A	10	27	16
B	14	28	16
C	36	21	10

i) Assign the duty to the staff using hungarian method [8 marks]

ii) Find the minimum total time taken by the staff. [2 marks]

d) Use simplex method to

Max $z = 2x_1 + 5x_2$

Subject to

$x_1 + x_2 \leq 10$

$2x_1 + x_2 \leq 8$

$x_1, x_2 \geq 0$ [10 marks]

e) State three properties of linear programming [3 marks]

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QUESTION TWO [20 MARKS]

a) Form the dual of the following LP problem

Min $z = 24x_1 + 30x_2$

Subject to

$2x_1 + 3x_2 \geq 10$

$4x_1 + 9x_2 \leq 15$

$6x_1 + 6x_2 \geq 20$

$x_1, x_2 \geq 0$ [4 marks]

b) Write a linear programming model for the General transportation problem [3 marks]

c) Consider the following LP problem

Max $z = 6x_1 + 8x_2$

Subject to

$5x_1 + 10x_2 \leq 60$

$4x_1 + 4x_2 \leq 40$

$x_1, x_2 \geq 0$

i) Solve the LP [8 marks]

ii) Hence find the new solution if

I) The right hand side constraints of the constraint 1 and constraint 2 are changed from 60 to 40 and 40 to 20. [3 marks]

II) If a new constraint $7x_1 + 2x_2 \leq 65$ is added [2 marks]

QUESTION THREE [20 MARKS]

a) Describe the types of transportation problem. [3 marks]

b) Obtain the initial basic solution using the following methods in the problem below.

i) North west corner cell method [5 marks]

ii) Least cost cell method [6 marks]

iii) Vogel's approximation method [6 marks]

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	D	E	F	G	Available (Supply)
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement (Demand)	200	225	275	250	950

QUESTION FOUR [20 MARKS]

a) Solve the following problem using Big M method. [13 marks]

Min $Z = 10x_1 + 15x_2 + 20x_3$

Subject to

$$2x_1 + 4x_2 + 6x_3 \geq 24$$

$$3x_1 + 9x_2 + 6x_3 \geq 30$$

$$x_1, x_2, x_3 \geq 0$$

b) A company has three factories located in three cities X, Y, Z. This factory supplies consignments to fur dealers A, B, C and D. The dealers are spread all over the country. The production capacity of these factories is 1000, 700 and 900 units per month respectively. The net return by unit is given in the table below.

Factories	A	B	C	D	Capacities
X	6	6	6	4	1000
Y	4	2	4	5	700
Z	5	6	7	8	900
Requirement	900	800	500	400	2600

Obtain basic feasible solution using North West corner method. [7 marks]

QUESTION FIVE [20 MARKS]

a) Dorian makes luxury cars and jeeps for high-income men and women. It wishes to advertise with 1 minute spots in comedy shows and football games. Each comedy spot costs $50K and is seen by 7M high-income women and 2M high-income men. Each football spot costs $100K and is seen by 2M high-income women and 12M high-income men. How can Dorian reach 28M high-income women and 24M high-income men at the least cost?

i) Develop and LP model. [4 marks]

ii) Hence use graphical method to obtain the optimum solution to the linear programming problem. [6 marks]

b) A foreman had four fitters and has been asked to deal with fire jobs. The times for each job are estimated as follows:

	A	B	C	D
1	6	22	12	18
2	12	18	16	14
3	20	15	18	10
4	12	20	15	17

a) Allocate the men to the jobs so as to minimize the total times taken and identify the job which will not be dealt with (use hungarian method). [10 marks]